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Physical Fitness Training for Patients With Stroke
An Updated Review

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Physical fitness is low after stroke and this may cause or exacerbate some common poststroke problems, including disability. It is not known whether improving physical fitness after stroke reduces disability or dependency.

Objectives
The primary aims of the review were to determine whether physical fitness training (cardiorespiratory and/or strength) after stroke reduces death, dependence, and disability at the end of intervention or follow-up. The secondary aims were to determine the effects of fitness training on physical fitness, mobility, physical function, health status and quality of life, mood, and the incidence of adverse events.

Methods
Search Strategy
We searched the Cochrane Stroke Group Trials Register (last searched March 2009), the Cochrane Central Register of Controlled Trials (Cochrane Library, 2007, Issue 1), MEDLINE (1966 to March 2007), EMBASE (1980 to March 2007), CINAHL (1982 to March 2007), SPORTDiscus (1949 to March 2007), Science Citation Index Expanded (1981 to March 2007), Web of Science Proceedings (1982 to March 2007), Physiotherapy Evidence Database (March 2007), REHABDATA (1956 to March 2007), and Index to UK Theses (1970 to March 2007). We hand-searched relevant journals and conference proceedings and screened bibliographies. To identify unpublished and ongoing trials, we searched trial registers and contacted experts in the field.

Selection Criteria
Randomized controlled trials were included where the aim of the intervention was to improve either muscle strength and/or cardiorespiratory fitness and whose control groups comprised no intervention, usual care, or a nonexercise intervention.

Data Collection and Analysis
Trial eligibility and quality were determined by 2 reviewers. One reviewer extracted outcome data as end of intervention and follow-up scores or as change from baseline scores. Meta-analysis was performed using the Cochrane Review Manager software, RevMan 5, to calculate effect sizes and 95% CIs. Diverse outcome measures limited the intended analyses.

Results
We included 24 trials, involving 1147 participants, comprising cardiorespiratory (11 trials, n=692), strength (4 trials, n=158), and mixed training interventions (9 trials, n=360). Death was infrequent at the end of the intervention (one of 1147) and follow-up (8 of 627). No dependence data were reported. Few disability outcomes were suitable for meta-analysis and most study effect sizes were not significant. Fitness training did improve physical fitness but functional benefits only occurred after task-related training, in particular

Table. Improvements in Speed, Tolerance, and Independence During Walking Assessed at the End of Cardiorespiratory Training Interventions*

Outcome	Trials (N)	Participants (n)	Mean Difference (Fixed-Effects Model)	95% CI	Significance (*P* Values)
Maximum walking speed	8	(462)	6.47 m · min^{-1}	2.37–10.6	0.002
Comfortable walking speed	4	(356)	5.15 m · min^{-1}	2.05–8.25	0.001
Walking endurance	3	(296)	38.9 meters	14.3–63.5	0.002
Functional ambulation categories	4	(228)	0.72	0.46–0.98	<0.00001

*Training interventions involved task-related (ie, walking-related) exercise presented before completion of usual rehabilitation.

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walking. The only consistent effect observed within the trials was that cardiorespiratory training involving walking improved a range of walking performance measures and reduced dependence on others for walking at the end of intervention (Table). The 8 of 24 trials that included additional follow-up measures suggest that any end-of-intervention benefits did not persist after the interventions had finished. Current data include few strength training trials and lack nonexercise attention controls, long-term training, and follow-up.

Reviewer Conclusions

The effects of physical fitness training on disability, death, and dependence are unclear. There is sufficient evidence to incorporate cardiorespiratory training, involving walking, within poststroke rehabilitation to improve speed, tolerance, and independence during walking. Current data include few strength training trials and lack nonexercise attention controls, long-term training, and follow-up. Further trials are needed to optimize exercise prescription after stroke and identify how long-term benefits can be achieved through effective implementation of physical activity programs.

Note: The full text of this review should be cited as Saunders DH, Greig CA, Mead GE, Young A. Physical fitness training for stroke patients. *Cochrane Database of Systematic Reviews*. 2009, Issue 4. Art. No.: CD003316. DOI: 10.1002/14651858.CD003316.pub3.

Disclosures

G.E.M. was the principal applicant, and D.H.S., C.A.G., and A.Y. were co-authors, of the STARTER trial (Mead et al, 2007) which is an included study in this review. This trial was funded by the Chief Scientist Office of the Scottish Government Health Directorates. A.Y. is married to a director of a company which provides training for those who deliver or supervise exercise for patients, including after stroke.

KEY WORDS: cardiorespiratory fitness ■ disability ■ exercise ■ muscle strength ■ therapy